Sudhal SR 2-52/RR-2/537

INTEGRATED DISEASE VECTOR CONTROL

SUMMARIES OF THE WORK DONE

Bench Review - 2001

Completed and Ongoing Projects
New Project Proposals
Other Activities

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Field Station Bangalore

1. Monitoring of Bioenvironmental control of malaria

1. **District Kolar**: Bioenvironmental control of malaria was first initiated in PHC Kamasamudram, district Kolar. API came down to 0.05 in 2000 from 41.8 in 1993. In 2001, monitoring of parasitological and entomological aspects were carried out in this PHC and also in PHC Devarayasamudra (for comparison) which is contributing high malaria from district Kolar.

1.1. **PHC Kamasamudram** : Mass blood survey (MBS) was carried out on 203 volunteers in this PHC and none was found positive. Only two vivax cases are reported from this PHC (upto August, 2001)

Entomological survey revealed that MHD of *An culicifacies* varied from 0.0 to 1.5 while PSD varied from 0.0 to 2.0. Likewise, MHD of *An. fluviatilis* varied from 0.0 to 1.0 while PSD varied from 0.0 to 3.0. The mosquitoes were found mainly from the villages located near the streams.

Monitoring of larvivorous fishes were also carried out. Fishes were found all the water bodies checked.

1.2 **PHC Devarayasamudra** : In this PHC MBS carried out on 122 volunteers revealed 24 were suffering from malaria having 11 *P. vivax* and 13 *P. falciparum*. In 2000, a total of 2288 malaria cases were reported from this PHC having 1487 *P. vivax* and 801 *P. falciparum*. In 2001 (upto August), a total of 1886 malaria cases are reported from this PHC.

Entomological study indicated that MHD of *An culicifacies* varied from 0.0 to 10.0 while PSD varied from 0.0 to 14.0. *An. fluviatilis* was not found from this PHC.

2. **District Hassan :**

2.1 Entomological monitoring in PHCs Banavara and Kanakatte : Entomological monitoring in these PHCs were carried out. In the first quarter, wells (84.6%) were found to be major contributor for *An. culicifacies* while in the May irrigation tanks (13.6%) were found to be major contributor. MHD of *An. culicifacies* varied from 3.00 to 20.5 while in control area it was 39.5. Likewise, larval densities varied from 0.04 to 0.33 in experimental area and 1.04 in control area. A total of 99 samples of ovaries of *An. culicifacies* have been processed for sibling species composition; 59 were species A while rest 40 were species B.

Insecticide susceptibility status was also assessed. It was found that *An. culicifacies* was found resistant to DDT (mortality 39.84%) while susceptible to Malathion (97.2%), Deltamethrin (100%) and Cyfluthrin (100%).

Monitoring of larvivorous fish was also carried out in these PHCs. In this dry belt most of the wells got dried. Of the total 114 wells checked in 18 villages 21 were found dry. Reintroduction of Gambusia (total number 12,700) and Guppy (600) were carried out in 7 step wells, 10 irrigation wells and 52 draw wells. Introduction of larvivorous fishes were also carried out in 7 experimental villages where only bed nets were used.

A total of 151 malaria cases were reported from PHC Banavara while 144 cases from PHC Kanakatte (upto September, 2001). This is comparatively less that the control PHC (Panchnalli) where 422 cases have reported. It is observed that all the bordering villages of PHCs Banavara and Kanakatte are reporting maximum malaria cases (about 85%).

2. Evaluation of the impact of DDT indoor residual spraying :

Evaluation of the impact of DDT (50%) indoor residual spraying in being carried out in malaria control programme in Mandya district. The study is being conducted in 7 villages of sub-centre Mahadeshwarapura of PHC Pandavapura (Pop. 7665).

3. Remote Sensing for delineating of breeding habitats of *An. culicifacies*:

In the ongoing collaborative remote sensing project breeding habitats of *An. culicifacies* were delineated in PHC Bukkapatna, Sira Taluk, district Tumkur. The main breeding sites are irrigation wells, bundh areas, tank bed pools and streams. The MDH of *An. culicifacies* varied from 0.5 to 10.5.

4. Roll Back Malaria in Tumkur district : An evidence based analysis of malaria situation was conducted in district Tumkur in August and September, 2001.Two one-day workshops - one at district level and the other at PHC level were conducted to involve the non-health sectors in the malaria control programme in Tumkur district.

Entomological and parasitological surveys were conducted in PHCs Mathigatta and Huliyar and Dasaudi, C.N. Halli Taluk of district Tumkur. The MHD of *An. culicifacies* varied from 0.02 to 25. *An. culicifacies* was found susceptible at 45% to DDT (4%). The 7-day *in vivo* susceptibility test on 12 patients revealed *P. falciparum* was susceptible to chloroquine.

5. Urban malaria / Mosquito control

Mangalore City : Malaria control in the Mangalore city is being carried out with the active co-operation of local NGOs and corporation. There was an marginal increase of

malaria cases in the city. Maximum cases are contributing from four wards. It was revealed that malaria is under control in the wards where Guppies were released earlier. The local district administration is taking all necessary measures to control malaria in the city with the technical assistance of MRC. The local Zilla Parishad has also taken necessary steps to control malaria in the Dakshina Kannada district. Subsequently, a total of 15,000 Guppies have been supplied to the District Malaria Office, D.K. District. The fishes were released in plastic tanks in 88 schools. The tanks were provided by the corporation in these schools for further distribution through school children. The local NGOs also rearing Guppies in their areas. In October about 40,000 Guppies have been supplied to the DMO. D.K. district. Local fisheries department is also assisting in transporting and releasing of fish.

Earlier, health education camps and lectures were organised in the local school and colleges. Life cycle of malaria parasites and mosquitoes along with their breeding habitats and proper control measures were explained to the students. Live larvivorous fishes and mosquito larvae were demonstrated to highlight the role of biological agents in malaria control programme. Expanded polystyrene (EPS) beads was also displayed to know about its use to control of mosquito breeding habitats specially in unused wells. Training on bioenvironmental control of malaria was given to 12 Health Inspectors of Mangalore City Corporation.

In addition to the work in Mangalore, a meeting was also held with the State Health Officials like DHO, DMO in district Udupi. Meetings were also held with the Deputy Commissioner, CEO, ZP and Chairman, Udupi Municipal Council. Afterwards the team visited one of the problematic villages in Malpe area and released 300 Guppy fishes in three wells.

As per the request of the DHO, district Udupi, 5000 Guppy fishes have been supplied to the DMO, Udupi from the stock of MRC, Bangalore

Mosquito control in Bangalore City : Mosquito nuisance is one of the major problems in Bangalore city. Recently constituted Bangalore Agenda Task Force (BATF) has initiated `Swachha Bangalore' programme to keep Bangalore City clean and mosquito free. The mosquito control programme will be carried out with the help of Bangalore City Corporation and BATF. As requested by the corporation training to the health personnel engaged on mosquito control was rendered. A total number of 11 Insect Collector, 20 Head Gangmen and 376 ALOs and Gangmen have undergone training on mosquito control in MRC. The project is financed by BCC.

Geographical Reconnaissance of mosquito breeding habitats in Lingarajpuram (Ward No. 87) the city has been carried out. The GR was jointly conducted by MRC, BMP and a local Health Institute. Initially, training on mosquito survey was rendered to all the staff. This ward has 67 blocks having population around 56,000 and comes under Bharatinagar range. During GR, a total of 14, 252 probable mosquito breeding sites were found. Of these, unused wells (n=750) and nullas contributed maximum mosquito breeding. Culicines (82%), Aedes (11%) and Anophelines (7%) were found in this ward. The GR report along with the recommendation for intervention has been submitted to the BCC for implementation. Regular monitoring is being carried out in other zones of the city as well as in the study areas. 27 localities have been surveyed for mosquitogenic situations. The survey is being carried out with the assistance of local Medical Officers

and Health staff. In the survey it has been observed that there are many natural stocks of Guppy are present in the city. As recommended, release of Guppy fishes are being carried out routinely by the health staff of BCC. Fishes are also supplied by MRC from time to time. It has decided to provide Health Education to core members of the Resident Association from each ward.

6. Malaria Clinic : A total of 72 blood smears were checked in the malaria clinic of which 3 were found positive for malaria and all were *P. falciparum*.

Month wise data → Action taken?

Anti-malaria month observation (June, 2001):

- Organised health camp in Bangalore on the occasion of Anti-malaria month observation in the state.

- Participated in four anti-malaria month observation meetings and organised health camps depicting bio-environmental control of malaria in districts Davangere, Tumkur and Chitradurga. These were jointly organised by NAMP, State Health Department and Directorate of Field Information and Publicity, Govt. of India.

- Participated and organised health camp in a slum area in Bangalore City for anti-malaria month observation. This was organised by Directorate of Field Information and Publicity, Govt. of India.

Extramural Projects :

Project 1
Operational feasibility of use of larvivorous fishes for control of malaria in a high risk area of Karnataka State, India.

The project is initially for one year and may be extended for the second year.

Budget : First Year

S.No.	Particulars	Amount in Rs.
1.	Workshops for advocacy and sensitisation. - 1.1 State level - one workshop - 2 days 1.2 District level one workshop -2 days	47000.00
2	Materials (plastic bags, oxygen cylinder, canisters, ropes, nets, strainers, ring nets, plastic drums, plastic buckets)	70500.00
3	Transportation	164500.00
4.	Travel	117500.00
5	Wages for casual workers for fish catching and releasing	94000.00
6	Socio-economic-political and cultural Study	23500.00

7.	Computation, Report writing, stationary	47000.00
	TOTAL	**564000.00**

Project 2

'Stratification of Karnataka based on *An. culicifacies* and *An. fluviatilis* sibling species prevalence'.

This project was submitted for funding to the WHO SEARO under RBM. After screening the committee has recommended for operational project which has been submitted for Ministry's clearance.

The revised Project under RBM :

New Project

Study on the relapse pattern in *Plasmodium vivax* in wetland ecosystem in Karnataka.

1. Partnership ? CHC not mentioned at all ?
   i) Mangalore workshops
   ii) RBM Guidelines
   iii) School module
   iv) CN Halli project

2. Impact assessment - needs to be more carefully planned | Control PHC ??
   Spraying done / not done
   In some areas what else done

3. IVC - means old vc operations to be monitored

4. Mosquito control should be focus | Recolonization will
   Anophelines must
   more change to all
   vector species relevant
   to state

5. SEPC study ?

6. Community Mobilization is not an adjunct but a core component and research should be equally rigorous

7. KTEH / IHNP Project ?

Collaborative Projects ??

1. MRC Clinic Activities

A malaria clinic for prompt diagnosis and treatment is functioning in the premises of the Centre. Patients from nearby areas like Mogappair East, Mogappair West, Padi, Padipudhu nagar, Annanagar West etc. visit the clinic for immediate diagnosis and treatment. Malaria cases diagnosed are promptly treated with Chloroquine and Primaquine as per NAMP drug schedule. The case particulars are promptly sent to the Directorate of Public Health and Preventive Medicine and Corporation of Chennai according to their jurisdiction for further preventive action. Monthwise malaria case particulars for the year 2001 (JANUARY – SEPTEMBER) at MRC clinic are given in Table-1. A total of 2839 blood smears were collected out of which 356 (12.53 %) were reported to have contract malaria. Pf cases recorded were 18 and constituted 5.0 % of the total malaria cases.

Table-1: Malaria Case Particulars At MRC Clinic.

Month	BSE	POS	Pv	Pf	SPR	SFR	Pf%
January	417	44	39	5	10.6	1.2	11.4
February	374	49	48	1	13.1	0.3	2.0
March April	292	51	50	1	17.5	0.3	2.0
May	220	45	44	1	20.5	0.5	2.2
June	236	44	42	2	18.6	0.9	4.5
July	194	31	29	2	16.0	1.0	6.5
August	198	41	38	3	20.7	1.5	7.3
September	323	20	20	Nil	6.2	Nil	Nil
	585	31	28	3	5.3	0.5	9.7

2. Bio-ecology of variants of *An. stephensi.*

Immature anopheline collections were undertaken in different localities in and around Chennai to identify and map areas according to the different ecological variants. Determination of the variants was mainly dependent on the successful colonization from the immatures collected. Egg ridge number was used to determine the variants. Within the corporation limits, collections have been undertaken in Anna Nagar, Padikuppam, K. K. Nagar, Kilpauk, and Arumbakkam areas. Outside the city limits, Pammall, Red Hills, Guduvancherry, Iyapakkam, Mogappair, Erambalur and Mangadu were surveyed. *Anopheles stephensi* collected at Anna Nagar and Padikuppam area in the city and Iyapakkam, Erambalur, Mangadu and Red Hills outside the city limits were found to be intermediate forms. Type form was obtained in Erambalur, Mangadu and Red Hills area. Mysorensis was present in Erambalur only. During the period a total of 337 OHTS, 384

Wells, 18 outside tanks, 5 underground tanks and 6 cisterns were checked for vector breeding. More collections are being initiated in the above said areas.

Feeding experiments have been conducted to study the sporogony and infectivity under laboratory conditions. A total of 13 patients who volunteered for the study were allowed to blood feed individually a known number of *An. stephensi* var mysorensis mosquitoes by direct method. The gametocyte count of the patients ranged between 200/µl and 2520/µl of blood. Dissections were carried out from the 7^{th} day. Gut and gland positivity was observed from 7^{th} and 10^{th} day onwards. The gut positivity rate observed on the 7^{th}, 9^{th} 10^{th} and 13^{th} day after infective feed was 33.3%, 78.57%, 50.0% and 80.0% respectively. Sporozoites were observed on the10^{th} and 13^{th} day and the sporozoite positivity obtained was 33.3% and 25.0%.

Life table attributes of *An. stephensi* var. mysorensis was studied in the laboratory during the month of June 2001. The results of the first cycle of experiments showed egg hatching rate and adult emergence rate to be 57.6% and 34.0 % respectively. The immature duration was observed to be 8 days.

3. Evaluation of HIMLIN (an IGR Compound) against *Culex quinquefasciatus* in unused domestic wells

The larvicidal efficacy of the Igr compound, Hilmilin applied at the rate of 0.04ppm/m^2 and 0.1ppm/m^2 was evaluated against *Cx. quinquefasciatus* breeding in domestic wells. A preliminary survey was conducted in Madhavaram and Red Hills area for selection of wells. A total of 158 wells were checked and 15 wells, five each for control, 0.04ppm and 0.1ppm(experimental) were selected. Easy approachability for sampling, unused and unpolluted without any fishes, minimum water depth of 3.0 feet and availability of *Cx. quinquefasciatus* breeding were some of the main criteria for selection of wells.

Evaluation was carried out for a period of five weeks during the months of July and August 2001. The pre-treatment density per dip recorded in wells used as control, and in wells treated with 0.04ppm/m^2 and 0.1ppm/m^2 were 66.8, 66.3 and 71.72 respectively. .The percentage reduction obtained on the 7^{th},14^{th}, 21^{st} and 28^{th} day were 41.0%, 60.0%, 19.0% and 9.0% on application of 0.04ppm/m^2 and 30.69%, 77.19%, 30.69% and 78.12% respectively when applied at the rate of 0.1ppm/m^2 .

4. Rain water harvestiving and its implication on mosquito breeding.

A total of 35 housing flats with Rain harvesting facilities have been surveyed in Chennai for conducting longitudinal studies on vector breeding. The probable and potential vector breeding sources for regular monitoring was identified. They include 65 rainwater harvesting wells, 7 soakage pits and 1 RWH sump. All rainwater collecting channels present in all the 35 houses depending on their availability have also been selected for observation on mosquito/vector breeding. Since most of the rainwater harvesting structures are covered by solid and heavy concrete covers suitable methods of immature or adult sampling is being determined for further studies.

5. Studies on bednet usage

A survey to collect information on the bed net usage was undertaken in Chintadripet, Velachery, Royapuram and Washermanpet in Chennai. Households were randomly selected in these areas and interview based upon a pre-designed questionnaire was conducted with one of the family members present in the house. A total of 128 households were visited for the purpose. Only 6.25% of the household used bed nets for protection against mosquito bites/mosquito borne diseases.

Patients visiting the MRC Clinic for diagnosis and treatment were also randomly selected and interviewed on bed net usage. Out of the total 74 patients interviewed, only 5 (6.75%) reported the use of bed nets.

6. Insectary:

The following cyclical colonies of mosquitoes are being maintained in the laboratory.

Anopheles stephensi - Intermediate.
Anopheles stephensi - Mysorensis

An. stephensi collected from Poonamallee, Madhavaram, Padikuppam, Pammal, Red hills, Mangadu, Kilpauk, Erambalur, Iyapakkam, Arumbakam, Anna Nagar west and Mogappair were maintained as temporary colonies until identification of variants.

7. Health Eduaction.

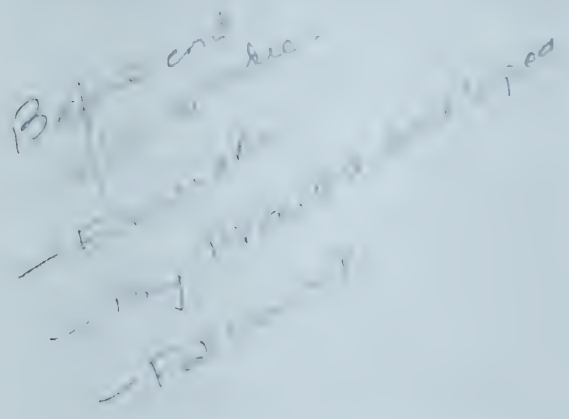
Health education on malaria and training on clinical techniques were conducted at the Centre for 205 students belonging to 9 institutes. PGDMLT students were trained on blood smear collection, staining techniques and identification of malaria parasites. Lectures on malaria and its control were included in the sessions along with live displays and video programmes on malaria. Students were highlighted on the importance of mosquito proofing of overhead tanks and wells to prevent vector breeding.

A total of 38 Medical (Health) officer trainees from Madras Medical College and Institute of Public Health, Poonamallee, Chennai visited the Centre for being apprised on the Malaria situation in Chennai, Tamil Nadu and the problems faced in malaria control.

Anti malaria month was observed by conducting an anti malaria campaign and exhibition on 28.6.2001 in collaboration with the Exnora club (NGO) of Anna Nagar at the Anna Nagar Ladies club, Anna Nagar. The inaugural function was presided over by Group Capt.V. Ramani and special address was given by Mrs. Rajeswari Menon, Principal, SBOA Matriculation and Higher Secondary School, Anna Nagar. Residents of nearby areas visited the exhibition. In order to carry the message to the student community, one-day training programme was arranged simultaneously for school and college teachers. Teachers from 11 Schools in and around Anna Nagar participated in the training programme.

As a follow up measure of the anti malaria campaign, lecture cum demonstration programme on Malaria and its control was organized by MRC at Anna Adarsh College for Women, Anna Nagar and Southern Pearl Matriculation school, Mogappair. A total of 342 students attended the programme. A science exhibition was organized by the MGR

Adarsh School, Mogappair and a total of 2500 students from various schools visited the exhibition. The students were highlighted on the problems involved in malaria control and the need for public cooperation.



Collaborative Projects And Study Status

Name Of The Project	Principal Investigator	Funding	STUDY STATUS AT CHENNAI
Use of molecular and cytotaxonomic techniques to study *Anopheles culicifacies* complex and its relationship to malaria transmission in India and Sri Lanka. (Indo-Sri Lanka collaborative project: 1998 – 2000)	Dr. Sarala K. Subbarao and others	Extramural (Dept. of Biotechnology, Govt. of India).	On account of intensive residual spray operations, collections of *An. culicifacies* have not been undertaken.
Phase II prospective study to determine efficacy of 80/53 as gametocidal drug in case of uncomplicated *P.falciparum* malaria.	Dr.T.Adak, MRC, Delhi and others	Intramural	Studies will be initiated from the month of November to February, the peak Pf transmission season in Chennai.
Plasmodium vivax: Genetic Diversity and epidemiological significance	Dr.Sarala K. Subbarao & Dr. Hema Joshi, MRC, Delhi.	Extramural (DST)	Study not initiated.
Bio-chemical characterization and expression of *P. vivax* aspartic proteinase involved in haemoglobin degradation.	Dr. Arun Sharma, MRC, Delhi	Extramural (DBT)	Blood sample collections in high incidence areas in Chennai and extension areas have been undertaken. Study in progress.
Bio-diversity of mosquito population in different climatic zones of India	Dr.BN. Nagpal. MRC, Delhi.	Extramural (MoE)	Sanction awaited. Study not initiated

Field Station Jabalpur

1. Clinical Trial of Azithromycin and Chloroquine combination in uncomplicated *P. falciparum* malaria:

An open label clinical trial of Azithromycin and chloroquine combination in the treatment of uncomplicated *P. falciparum* malaria is being carried out in collaboration of Medicine department Medical College Jabalpur as a part of sponsored research. A total of seven patients were enrolled during this year and successfully treated with this drug combination. Asexual parasitaemia and symptoms of malaria cleared within 48 hrs of initiation of therapy without any adverse complications. 28 days follow-up were completed without any recrudescence. Interim analysis of clinical data is on progress.

2. Tolerability and efficacy of Artesunate plus chloroquine or sulphapyrimethamine combinations Vs single- agent chloroquine or sulphapyrimethamine for uncomplicated falciparum malaria:

The trial is being carried out in this field station under RBM. Four groups of uncomplicated falciparum malaria were made. Two groups were given monotherapy of either chloroquine or sulphapyrimethamine and other two group were given either chloroquine+artesunate or SP + artesunate.. 6 patients grouped in second group were enrolled in cq.+artesunate and sp +artesunate for observing safety, tolerability and efficacy of drug combination. This group was found safe for treatment of P. falciparum malaria. Parasitaemia and symptoms cleared within 48 hrs of therapy and successfully completed 28 days follow-up without recrudescence.

5 patients were also enrolled in single therapy groups of cq and sp each. Follow-up is in progress.

3. Evaluation of the impact of DDT indoor residual spraying being used in malaria control programmes on diseases prevalence (DDT project):

The study was conducted in four villages of Mohkhed PHC district Chhindwara.

4. Epidemic investigation in Betul District:

Cross sectional surveys were carried out in 22 malaria affected villages of Bhimpur, Chicholi and Shahpur PHC of District Betul (under EMCP) in March, May, June and September months of this year as part of follow up investigation of malaria outbreak. A total no. of 991 blood smears of patients with febrile illness were collected of which 330 were malaria positive (128 Pv, 273 Pf and 9 mixed infection of Pv and Pf). The SPR, SfR and Pf% were 33.3, 27.5 and 82.7 respectively. 399 children were examined for spleenomagly of which 230 had enlarged spleen. Spleen rate and average enlarged spleen were 57.6 and 1.92 respectively. The SPR among spleen cases was 39%.

The District was sprayed with synthetic pyrethroids in April and June. The average anopheline density of these villages was very low (7.5) of which An. culicifacies was dominant species (4.8) , However during light trap mosquito collection , the density

of anophelines per trap was 3.4 in indoors and 23.5 in outdoors. An. culicifacies was dominant species in both.

5. Malaria situation in Mandla District:

The entire District is under EMCP. Rapid fever surveys were carried out in villages of Bizadandi and Narayanganj PHCs during Jan to Sep 2001. A total no. of 1133 blood smears were collected of which 221 were found malaria positive (58 Pv, 162 Pf and 1 mixed infection of Pv and Pf). The SPR, SfR and Pf% were 19.5, 14.3 and 73.3 respectively.

6. Trial of Paracheck test in diagnosting asymptomatic carriers of falciparum malaria:

A total of 573 school children having no signs of malaria were tested with Paracheck test kit, out of which 158 showed positive (falciparum) test. Simultaneously blood smears of those 573 children were also prepared out of which 140 were malaria positive (126 Pf, 11 Pv and 3 mixed infection of Pv and Pf). The sensitivity and specificity of Paracheck Vs thick smear were 94.4 and 89.0 respectively. PPV, NPV and accuracy were 71.0, 98.0 and 90.0 respectively.

New Projects:

1. Malaria Vaccine-Related Field Study in Jabalpur, India.

Objectives: The overall objective of the study is to develop a well characterized site, where the epidemiology of the disease, immune responses to malarial antigens, diversity of parasite genes, malaria paradigm changes and vector characteristics are well understood using appropriate statistical softwares (Epi Info-2000, etc). This study would be useful for testing of any tools for the control and prevention of malaria, such as antimalarial vaccines and diagnostic reagents. A clinical epidemiologist preferably from NIE, Chennai (Subject to availability) will be involved in the study. NAMP will be involved for site selection in Mandla district. At the end of every year (from the actual date of the initiation of the project), an advisory committee will meet and monitor the progress of work and suggest improvement if needed.

Sample size: For the prospective study, sample size is based on a balance between including a large enough population to detect patterns in changes in immune response and the ability to maintain high quality measurements over the life of the study. Approximately 600 complete data sets on individual family (from birth of baby to third birthday) will be sufficient to supply an adequate sample size to meet the combined goals of the laboratory-based investigations. To complete this study, assuming 40% loss in the follow up, it will require enrolling nearly 1,000 mother infant pairs and other members in the family. In the case of cross-sectional community and hospital based studies, a total of 200 and 100 individuals, respectively will be asked to participate. Epi Info-2000 and other appropriate softwares will be used for data analysis as and when required.

For gathering information on nutritional status, National Nutritional Monitoring Bureau (NNMB) unit of NIN (ICMR) located at Jabalpur (under RMRC, ICMR) will be requested to participate.

For other common ailments i.e. diarrheal disease, respiratory infection and causes of anaemia and low birth weight i.e. concerned departments of Medical College/PHC Hospital will be approached for help and technical guidance.

Field Station: Sonapur

1. Evaluation of the impact of DDT indoor residual spraying being used in Malaria control programme on the disease prevalence.

Project Co-ordinator	:	**Dr. S.K. Subbarao** **Director, MRC**
Co-Investigator	:	**Dr. Vas Dev**
Funding Source	:	**ICMR**
Status	:	**Ongoing**

Based on the criteria for selection of study villages, malaria endemic pockets of Sonapur PHC (Kamrup District) were identified for follow up investigations.

2. Combination therapy in treatment of *P. falciparum* malaria (Azithromycin + Chloroquine)

P. Investigator	:	**Dr. P.C. Bhattacharyya** **Prof. & Head, Deptt of Medicine** **Gauhati Medical College.**
Co'I	:	**Dr. Vas Dev**
Sponsor	:	**Pfizer Ltd.**
Status	:	**Ongoing.**

Patients between age 18 to 60 years with positive blood smear for ***P. falciparum*** were administered combination thereby (Chloroquine @ 25 mg/kg body in divided doses over 3 days + azithromycin @ 1 gm once daily for 3 days) under supervision of medical officer. Patients response to therapy were monitored by assessing clinical parameters and parasitological follow up on D1 to 3,7, 14 and 28 and /or up until blood smear is negative for parasite. Parasitological data of 22 completed cases are presented. It was observed that in 12 patients (4% of cases) parasitaemia were cleared within2 days (48 hrs) and in 8 cases (36%) within 3 days (72 hrs), and in 2 patients (10%) peripheral smears were negative on 4^{th} day. No recrudescence were observed within 28 days of follow up study.

3. Malaria Clinic

P. Investigator	:	**Dr. Vas Dev**
Funding Source	:	**Extramural (IDVC)**
Status	:	**Ongoing**

It is an ongoing activity to ensure early case detection and prompt treatment of the invisiting fever patients, and is also an bio-resource of malaria related investigations. Malaria cases were detected during all months of the year yet there was an sudden

increase in number of fever/ Pf cases beginning May upuntill September corresponding with the rainy season (the peak transmission period) slide positivity rate (parasite rate) ranged between 7% to 33 percent, and most were ***P. falciparum*** cases (73%), and the remaining were ***P.vivax*** infections.

4. Monitoring of multi-drug resistant malaria in N.E. region.

P. Investigator : Dr. Vas Dev
Co. Investigators : Dr. B. Das (MBBS)
Incharge, Sonapur PHC
Dr. Rupjoyti Talukdar (MBBS)
Deptt. of Medicine
Gauhati Medical College
Funding Source : Extramural (IDVC)
Status : Ongoing.

In continuation, this year the study was undertaken in Sonapur PHC(Kamrup district) in accordance with the protocol developed by NAMP for determining therapeutic efficacy of anti-malarial drugs for treatment of ***P. falcipuram*** malaria. Form the passive case detection agency (malaria clinic), 24 patients positive for ***P. falciparum*** malaria were selected for follow up investigations to test the therapeutic efficacy of chloroquine, S-P compound and quinine in the given order. On extended follow up (Day 0, to 3, 7 & 14), it was observed that 15 (62%) cases were sensitive to standard regimen (ACR), 7 (29%) cases exhibited late treatment failure (LTF), and 2 (9%) were early treatment failures (ETF). The latter 2 cases were treated with parenteral quinine by the medical practitioner. Of the 7 cases of chloroquine failure (LTF), 6 were sensitive to S-P, and the remaining one case was treated with quinine.

New Projects for Sonapur (Assam)

1. Project Title : Antimalarial drug resistance studies in Asia
Co- Investigators : Dr. Vas Dev
Funding Source : WHO (SEARO)

2. Project Title : Bio-diversity of mosquito populations in different climate zones of India.
Co- Investigators : Dr. Vas Dev
Funding Source : Ministry of Environment , GOI

3. Project Title : Questionnaire for private practitioners on consumption of anti-malarials/ drug practices in N.E. Region.
Principal Investigator :Dr. Vas Dev
Funding Source : Extramural (IDVC)

4. Project Title :Efficiency of indigenous fishes, *Puntius, Chanda* and *Colisa* Species in the enroll of mosquito breeding in Assam.

Principal Investigator	**:Sh. Paban Chandra Saikia** **Lecturer, Morigaon College**
Co-Investigator	**: Dr. Vas Dev.**
Funding Source	**:UGC**

Field Station Haldwani

1. Malariogenic Stratification of the Districts Nainital And Udham Singh Nagar For Malaria Control Measusres:

Funding source: **Intramural**

At microlevel to identify T.R. factors in 4 high malaria risk PHCs i.e. Kela Khera and Gadarpur from Terai of District Udham Singh Nagar and Mota Haldu and Belparao from Bhabar of District Nainital detailed maps showing various sectors were collected. Sector wise SPR and API since last 5 years were also obtained from respective PHCs.
There are 8 sectors in Kelakhera, 13 in Gadarpur, 13 in Mota Haldu and 11 in Belparao. Sector wise average of the SPR and API were analysed and identified as high and low malaria areas. In Kelakhera PHC the high (16) malaria was recorded in kelakhera sector and low (6) in Banna Khera, Sultanpur Patti & Haripura Harsan sectors. In Gadarpur PHC, the high (16) malaria was found in Gadarpur, Surajpur and Balram Nagar and low (2) in Khempur and Bhajpuri sectors. In Mota Haldu PHC, the high malaria (12) was recorded in chorgalia and no malaria (0) in Kuwarpur and Kamaluwa Ganja sectors and in Belparao PHC, the high malaria (12) was found in Belparao and no malaria (0) area is Sawalday sectors area.

Other information's viz: socio-economic, socio-cultural, drug distribution centre, fever treatment depot, malaria clinic, EDPT, migration, structure of houses, sleeping habits, insecticide spray and age and sexwise data were recorded from high and low sectors of the PHC. Besides above informations, during the year, 2001 one village each from high and low malarious areas of two high risk PHCs i.e. Mota Haldu in bhabar and Gadarpur in terai, mass blood surveys were made to know the malaria situation. The results revealed that in Gadarpur PHC the SPR and SFR in Balram Nagar of the same sector area was 25.0 and 11.4 percent, respectively and in Bhajpuri from the same sector area the percentage was 7.5 and 1.8, respectively. In Mota Haldu PHC from the village Pachaunia of Chorgalia sector the SPR and SFR was 19.6 and 13.0 percent, respectively whereas in Kamaluwa Ganga village of the same sector was 11.8 and 0.0, respectively.

The informations obtained sofar were co-related with malaria transmission, which revealed no significant differences for high and low malaria prevalence in the areas. In Terai and Bhabar areas malaria is transmitted locally by both *A. culicifacies* and *A. fluviatilis* malaria vectors.

2. Small scale field trials of *Bacillus thuringiensis* for the control of mosquito larvae in different habitats of Kumaon region, Uttaranchal.

B. Contract Project
Funding Source : Extramural
Small scale field trials of bio-larvicide (WP) *Bacillus thuringiensis* supplied by M/s Wockhardt India Ltd. were carried out against mosquito larvae breeding in various habitats in and around Haldwani, Kumaon region, Uttaranchal.

Before application, area of a particular breeding site was measured and the bio-larvicide was applied with the dosase of 0.5 gm./m2 Spray impact was assessed on the densities of 3rd and 4th instar mosquito larvae. Results were compared with those of the unsprayed habitats of the similar nature. Larval densities both in experimental and control were monitored daily for a week and thereafter, weekly. The sites were retreated weekly after rebuilding of larval densities.

River bed pool: Average density of anopheline larvae before treatment was 32.5 per dip. After application densities were decimated and recorded nil upto 5th day. However, the post treatment observation revealed rebuilding of larvae on 6th day and the percent reduction was found to be 76.4% on 7th day after treatment. The study was continued up to 35 days.

Cement tanks: The average density of 3rd and 4th instar culicine mosquito larvae before treatment was 133 which, reduced to 0.1 (99.9% reduction) on day 1 after treatment. On 7th day after treatment larval densities were recorded 0.3 in experimental. The impact was monitored, up to 63 days, at weekly reapplication of biocide.

Pokhars (small ponds): Average density before treatment was 388.0 per dip in experimental, which reduced to 0.8 on day 1 after treatment. On day 6 the density rebuilt to 38.8 per dip. These were reduced after re-treatment on 7th day. The observations were made up to 21 days.

Paddy fields (Summer Crop): Average density of 3rd and 4th instar anopheline larvae before treatment in experimental was 4.1 and 3.6 in control. After application larval densities were decimated in experimental. However, the densities were rebuilt after 5 days (0.3 per dip). Impact on culicine larvae was similar to that of anopheline. The study lasted up o 35 days. However, impact of bio-larvicide spray in paddy fields declined after the thick vegetation of plants. Nevertheless the bio-larvicide spray had good impact on malaria vector larvae found breeding only during the early growth of plants (upto 60 cm. height).

Pits and ditches: Average density of culicine larvae before treatment was 332.0 which reduced to 5.7 (98.2% reduction) on day 1 after treatment. On day 6 after treatment percent reduction was 99.8 percent. Further application was done weekly and the observations were monitored up to 3 weeks.

From the results collected from various habitats it may be concluded that the bio-larvicide *B. thuringiensis israelensis* is highly effective against mosquito larvae. However, reapplications were required due to rebuilding of larval densities. It may be either due to continuous process of oviposition by mosquitoes or absence of recycling capacity in the bio-larvicide.

3. Evaluation of the Impact of DDT residual spraying being used in malaria control programmes on the disease prevalence in bareilly district, Uttar Pradesh.

MRC Project
Funding Source : Intramural

This project has been initiated and a good amount of information and data have been gathered by the Field Station and the progress of this study is satisfactory.

4. Intensive Passive case study at OPD MRC, Field station, Haldwani

MRC Project
Funding Source : Intramural

At M.R.C. clinic from Oct., 2000 to Sept. 2001 a total of 834 blood slides were prepared and examined. Out of that 284 patients were found positive of malaria revealing 34.05 and 20.06 percent SPR and SFR, respectively. Highest 35.2 % slide falciparum rate was recorded in the month of Sept, 2001. Two cases of *P. malariae* one from Chorgalia and other from Polysheet area of Haldwani were also reported at OPD.

5. Training Centre of Malariology Course:

MRC Project
Funding Source : Intramural

Field station Haldwani since its establishment in the year 1982 is conducting training on Malariology, Entomology, Medical Entomology, Vector Biology, Epidemiology and Malaria Entomology organized jointly by MRC, NAMP and NICD Delhi to participants attending from various International and National Agencies/Organizations. Training comprises of terrain features, larval/adult ecology of vector species, mosquito fauna, epidemiology of malaria, irrigation malaria and other parasitological information.
Various meetings on malaria, vector control and health education and demonstration campaigns were organized locally. Malaria found in different epidemiological paradigms can well be demonstrated at Haldwani. The following important malaria paradigms shown to the trainees are: Irrigation Malaria, Tribal Malaria, Industrial Malaria, Forest Malaria and Border Malaria.

6. Other Actvities:

A. Inter Departmental Co-ordination:

1. Dam site fever and mosquito collection with request of DMO, Rudrapur.
2. Meeting with M.O.I/C , Mota Haldu on 22nd Nov. 2000 24th Apr., 01 and 22nd May, 01 and Belparao, PHC on 20th Dec.,2000.
3. Meeting with DMO, Rudrapur on 6th Dec., 2000 and 2nd July , 01 and discussed on current malaria situation in terai.

4. From M.O.I/C PHC Bhojpur, Moradabad district a total of 61 blood slides and 13 slides from DMO, Rudrapur district were received and examined. The results were sent to respective officials.
5. Meeting with S.D.O., Banbasa for lab and accommodation arrangements to the team visiting from H.Q. Delhi from 10th to 16th May, 01 and 25th July, 01 and also discussed malaria situation around anti-malaria drain area.
6. Meetings with C.M.O. and D.M.O., Bareilly on 18th June and 25th June, 01.
7. Meetings with M.O.I./C, Baheri on 27th June, 01 and discussed on malaria situation in border area of Rudrapur and Bareilly.
8. Meetings with DMO, Bareilly on 5th, 9th, 13th July, 01, 16th and 23rd Aug., 01 and 5th and 24th Sept., 01 on various issues of DDT spray study.
9. Attended District Magistrate/Collectorate office at Bareilly for District level data during DDT spray study.
10. Meeting with M.O.I/C, Chorgalia and discussed on malaria situation. on 10th Sept. 01.
11. Visited Shivpuri village in terai of Gadarpur with DMO, Rudrapur for fever survey and met to CMO on 12th September, 01.
12. Meeting with DMO, Rudrapur and discussed malaria problem in Indo-Nepal Border.
13. Visited Tumaria Dam area and met SDO and discuss malaria situation around the dam area.

B. Visit/Training:

1. A team of four persons from VCRC, Pondicherry visited field station, Haldwani for A. fluviatilis collection from 8-13 Nov., 2000.
2. Participants of Comprehensive Vector Control training course visited MRC, field station, Haldwani w. e. f. 17th to 22 March, 2001.

C. Health Education:

To create awareness about malaria control measures among community a total of 200 group meetings were held in DDT sprayed areas of Bareilly district where 2240 peoples attended. During malariogenic stratification study 75 group meetings were organized where 1245 peoples attended.

D. Anti-malaria Month:

In June 2001, a total of 196 group meetings/door to door visits and 2 health camps/exhibitions in 15 villages were made where 1824 peoples attended. A total 48 blood slides were prepared showing 12.5 and 4.2 percent SPR and SFR, respectively. In urban area two health /exhibition camps and 22 group meetings were organized where 445 persons attended. A total 567 cards/pamphlets on malaria were distributed.

E. New Research proposal:

1. In-depth study of entomological factors responsible for malaria transmission in some pockets of Bhabar area of district Nainital, Uttaranchal.
2. Intensive passive case study at malaria clinic, Haldwani.
3. Training centre for malariology and malaria entomology course.

Field Station Hardwar

1. Search for a New Sulfonamide as Antimalarial Drug

Principal Investigator : Dr. V. K. Dua
Co-investigators : Mr. N. C. Gupta, Dr. Sukla Biswas & CDRI Scientist
Funding source : Intramural
Duration : Up-to 2003

Oxidation of sulfadoxine was carried out with peroxydisulfate ion in presence of Ag+ ion as a catalyst to get different products formed during the oxidation process. The reaction mixture turned yellow within 10 min after initiation and than became dark-yellow to brown and finally dark brown precipitates were formed within 24 hrs.11 fractions were isolated at different reaction conditions of peroxidisulfate oxidation of sulfadoxine. In vitro study of all these fractions along with sulfadoxine as reference were carried out against P. falciparum culture. Results revealed that fraction code SF3 has maximum schizontocidal activity as compared to other fractions and gave 100% inhibition at a concentration of 0.16 µg/well. It is to point out that fraction code SF3 has 5 times more schizontocidal activity than sulfadoxine. Attempts are being made to isolate pure compounds from fraction code SF3. A method has been developed by using Sep-Pak cartridges for fractionation of reaction mixture. TLC method has been developed by using acetonitrile, methanol and chloroform as mobile phase with different composition for the separation of different compounds of fraction code SF3.

Requirement for Project Nos 1, 2 & 4
HPLC with UV detector (Total Cost Rs 10 Lakh): HPLC instrument is required for the analysis of drugs, oxidation products and for the isolation of various compounds from plants extracts. Presently we have one HPLC system which was purchased in 1986. This unit is giving day to day problems. Moreover spares of the instrument are difficult to get because of the very old model. Therefore, it may be necessary to purchase one HPLC for better out put.

2. Isolation, Characterization and Antimalarial Activity of Different compounds of *Andrographis paniculata*

Principal Investigator : Dr. V.K. Dua
Co-investigators : Mr. V.P. Ojha, Dr. Neena Valecha, Dr. C. Usha Devi and Dr. Raja Roy (CDRI)
Funding source : Intramural
Duration : Up-to 2002

Progress

After ascertaining substantial schizontocidal activity of some compounds isolated by in vivo and in vitro methods, studies were diverted to isolate more amounts of major compounds to investigate their structures and to further test their anti-parasite activities.

Structures of compounds code APR1, APR2, APR3 and APR7 were proposed on the bases of UV, IR, MS and 1H NMR spectral studies which are

i) 1,8-dihydroxy-3,7-dimethoxy-xanthene -9-one ,
ii) 1,5-dihydroxy-2,7-dimethoxy-xanthene-9-one,
iii) 1,2-dihydroxy-6-8-dimethoxy-xanthene-9-one and
iv) 1,2,6-trimethoxy-8-hydroxy-xanthene-9-one.

All six compounds were also tested for their anti-parasitic activity against *T. b. brucei*., *T. cruzi*, *T. colubriformis*. Results revealed that compound code APR3 showed good anti-parasitic activity against T.b. brucei with its IC50 <0.15 uM.

Requirement : HPLC*

3. Development and validation of analytical methodology for synthetic pyrethroid insecticides in contaminated air due to the use of mosquito repellents and their impact on human health

Principal Investigator : Dr. V. K. Dua
Co-Investigator : Ms. Rosy Gurwara
Funding Source : Intramural
Duration : Upto 2003.

Progress

A gas chromatographic method has been developed for the determination of allethrin in air samples. Contaminated air samples were collected at different intervals of time during and after the use of 3.6% allethrin containing mats (Baygon mat) and Baygon liquid vaporisers. Air samples were taken at 0.5, 3, 5, 8, 10 and at 14 after initiation of mosquito mat by using air sampler having methanol containing impingers. The concentrations of allethrin in air at 0.5, 3, 5, 8, 10 and 14 hrs in the room (3x3 m2) with cooler (window closed ; fan on) were 19, 36, 27, 24.3, 12.3, and 15.0 µg /m3 while in room with open winow (fan on) were 1, 4, 2, 1.3, 1.0, 0.3 µg/ m3 respectively.

Requirement

Air sampler (Total cost RS 20,000.00)
Air sampler is required to collect air samples for the above project. Presently we are getting the air sampler from PCRI, Hardwar. This process delay our work progress. Therefore, it is highly desirable to get Air sampler.

4. To investigate antimalarial properties of *Caesalpinia bonducella* Fleming.

Principal Investigator : **Dr. Virendra K. Dua**
Co-investigator : **Ms. Shikha and Dr. Usha Pillai**
Duration : **Up-to 2003**

Four fractions were isolated from Caesalpinia bonducella Fleming using different polarity solvents. In vitro study revealed that the IC50 values of fraction codes CB1, CB2, CB3 and CB4 were 37.5, 2.3, 17.3 and 25 µg /well respectively. Results showed that fraction code CB2 possessed maximum anti-malarial activity. Attempts are being made to isolate different compounds from fraction code CB2. A TLC method has been developed by using chloroform-methanol (95:5 or 85:5) for the separation of different compounds of fraction code CB2

Requirement: HPLC *

5. Synthesis of compound 6-methoxy 5,8 di-[4'-amino-1'-methyl butyl amino] quinoline (Compound Code P1)

Principal Investigator : **Dr. V. K. Dua**
Co-investigators : **Dr. V. K. Sharma and Dr. Suprabhat Roy (CDRI)**
Funding Source : **Intramural**

A MOU has been signed in July 2000 with CDRI, Lucknow for the synthesis of above compound as per SAC decision. Dr. Suprabhat Ray, Deputy Director was given responsibility and he further designated Dr. V. K. Sharma for the synthesis. Till now, nothing significant progress has been achieved regarding the synthesis of this compound despite of personal visits and reminders.

6. Industrial Malaria Control

Principal Investigator : **Dr. V.K. Dua**
Co-investigators : **Staff of MRC Hardwar**
Funding Source : **IDVC project on Malaria**
Duration : **Continue**

MRC Field Station, Hardwar is working on industrial malaria control since 1986 and successfully controlled malaria in BHEL, Hardwar, Indian Drugs and Pharmaceuticals Limited, Rishikesh and IOC, Mathura. Consultancy services on control of malaria in different industries are also being provided.

BHEL, Hardwar:
Bioenvironmental control methods have been successfully controlled malaria at BHEL, Hardwar. Regular intervention has been withdrawn from BHEL since 8 years. The

density of An. culicifacies the major vector species of the township was found low as compared to control area and that was confined to reverine area. A total of 45 malaria cases were recorded out of 2538 blood slides examined for malaria parasites in 2000 and only 6 cases were having *P. falciparum* infection. Most *P. falciparum* cases were found imported.

IDPL, Rishikesh:
The area is without intervention since 1991 and even malaria cases were also low in 2000 suggesting that the impact of bioenvironmental control strategy is long lasting. Malaria cases recorded at IDPL, Rishikesh showed that only 8 P. vivax cases were found out of 540 blood slides examined for malaria parasites with a SPR of 1.48.

IOC, Mathura:
Integrated vector control of malaria at IOC, Mathura was in the ninth year of operation with the aim of transfer of technology, Malaria cases recorded at IOC, Mathura gave 163 malaria cases out of 1791 blood slides examined. Malaria cases recorded in 1996, 1997 1998, 1999 and 2000 were 1388, 1004, 320, 313 an 163 respectively. It is to point out that only13 cases of P. falciparum malaria were identified in 2000. It is to point out that the malaria cases recorded in 2000 were minimum since MRC started intervention measures in 1991.

Requirement for project Nos. 3, 6, 7, 8

Vehicle (One)
Presently MRC, Hardwar has two vehicles for various field activities. One of the vehicle was purchased in 1987 and covered more than 3, 50,000 kms. This vehicle is brake down during field visits. Moreover the maintenance cost of this vehicle is increasing. Therefore, it is not practically feasible to run this vehicle for field activities. It is requested to replace this vehicle with a new vehicle for field work.

7. Evaluation of the impact of malathion indoor residual spraying being used in malaria control programme on the disease prevalence.

Principal Investigator : **Dr. S.K.Subbarao**
Co-Investigators : **Dr. V.K. Dua and Mr. A.C. Pande**
Funding Source : **Extramural**
Duration : **Upto March 2002**

This project was started in mid July when the first round of malathion was completed.

8. Investigation on Malaria at Laksar PHC of Dist. Hardwar

Principal Investigator : Dr. V.K. Dua
Co-investigators : Dr. P.K. Kar, Dr. Nutan Nanda & Dr. S.K. Subbarao
Funding Source : Intramural
Duration : 2002

Parasitological and entomological surveys were carried out in Laksar PHC of Distt. Hardwar on the request from the State Health Department. All slides of Laksar PHC collected by surveillance workers are being examined at MRC, Hardwar. It may be noted that Laksar PHC was highly endemic last year. A total of 1499 blood slides were examined during July-September 2001 and 114 cases were found positive (SPR 7.6). 76 cases were identified with P. falciparum infection while 34 had P. vivax malaria. Insecticide susceptibility test revealed that An.culicifacied was 40% resistant to DDT while it was 20% resistant to 5% malation.

9. Malariogenic potential of National Thermal Power Corporation (NTPC), Rihand Nagar (UP)

Principal Investigator : Dr. V. K. Dua
Co-investigator : Staff of MRC, Hardwar
Funding Source : Extramural (NTPC, Rihand Nagar)
Duration : Three years (Sept. 99 - Aug. 2002)

As per the condition of MOU, MRC team surveyed NTPC Rihandnagar from July 16-25,2001. 1803 blood slides were examined for malaria parasites from Jan-July,2001, out of which 283 (SPR=15.6) were found positive for malaria. 219 cases were identified with *P. falciparum* infection while 52 cases had *P.vivax* malaria. 4 cases were recorded with mixed infection. 215 blood slides identified +ve by NTPC with *P.falciparum* infection were re-examined. Results revealed that 174 (80.93%) slides were false positive (negative). Therefore it is suggested to trained NTPC technicians for proper examination of BS for malaria parasites.

Breeding source survey of 460 habitats of township resulted in 18% (83) positive for mosquito larvae. Similarly survey of adjoining area revealed 59 (34%) out of 173 positive for mosquito larvae. MHD of total mosquitoes, anopheles, vectors were 70, 65 and 11 respectively. Insecticide susceptibility test on An. culicifacies against malathion and deltamethrin showed that An.culicifacies was 80 and 100% susceptible to malathion and deltamethrin respectively.

10. Malariogenic potential of National Thermal Power Corporation (NTPC), Unchahar, District Raibarely, (U.P).

Principal Investigator : Dr. V.K. Dua
Co-Investigators : Staff of MRC, Hardwar
Funding Source : Extramural (NTPC)

A survey was carried out at NTPC, Unchahar to investigate mosquitogenic potential of this complex from April 15 –21, 2001 on the request of Chief Medical Officer of NTPC, Unchahar. All expenditure of the survey team was paid by NTPC. The team besides collecting general information, past malaria history and anti-mosquito activities also carried out extensive surveys of the township, factory area and adjoining rehabilitation colonies to find out mosquitogenic potential of this area. Remedial measures were suggested to control mosquitoes and malaria at NTPC, Unchahar. A survey report was also submitted to NTPC, Unchahar to implement remedial measures.

New Research Proposal

1. Investigation on Larvicidal properties of *Hibiscus abelmoschus* (Malvaceae)

Principal Investigator : **Dr. V.K. Dua**
Co-Investigator : **Mr. A.C. Pande**
Funding Source : **Intramural**
Duration : **Two years (2002-2003).**

Background:

Phytochemicals derived from various botanical sources have provided numberous beneficial uses ranging from pharmaceuticals to insecticides. Synthetic organic insecticides although highly efficacious against target species such as mosquitoes can be determental to a variety of animal life including man In addition to adverse environmental effects from conventional insecticides, most major mosquito disease vector borne become physiological resistant to many of these compounds These factors have created the need for environmentally safe, degradable and target specific insecticides against mosquitoes.. The search for such compounds has been directed extensively to the plant kingdom. The differential responses induced by phytochemicals on various species of mosquitoes are influenced by extrinsic and intrinsic factors such as the species of the plant, the parts of the plant, the solvents used for extractions etc. Particularly the extraction of the plant chemicals with specific solvents exerts a great influence in the resultant bioactivity. This is because the active constituent responsible for activity is extracted in greater measures in certain solvents. A review of the literature showed that very limited work has been carried on insecticides of plant origin against insect vectors of public health importance despite of very good flora and fauna. Preliminary studies have shown that water extract of the roots of *Hibiscus abelmoschus* (Malvaceae) processed substantial antilarval activity against the larval of Anophelines and culex mosquitoes.

It is proposed to investigate the Larvicidal properties of *Hibiscus abelmoschus* (Malvaceae).

Field Station Nadiad

1. Study on vector bionomics and evaluation of the sensitivity of malaria parasites to antimalarials in Surat

Investigators: **Dr. R.S. Yadav, Dr. R.M. Bhatt, Dr. S.K. Subbarao (all MRC), Dr. I.C. Patel and Mr. K.G. Vaishnav (Surat Municipal Corporation)**

Funding Agency: **Department for International Development, British High Commission, New Delhi**

Duration of project: 2 years

Objectives of the study were:

1. To assist the development of an appropriate and efficient entomological monitoring unit within the Surat Municipal Corporation (SMC) aiming at providing sustainable entomological support to the urban malaria control programme.
2. To study the vector bionomics in Surat in order to understand malaria transmission dynamics.
3. To evaluate the sensitivity of *P. falciparum* and *P. vivax* to anti-malarial drugs by *in vivo* and *in vitro* methods.
4. To evaluate the vector susceptibility to the currently used insecticides and larvicides intended to rationalise their usage in the programme, and to understand the mechanism of insecticide resistance through enzyme kinetics study.
5. To assess the need for engineering and environmental methods of vector control.

Progress of work done: The project was started in January 1999. Objectives number 1 to 3 were completed during 1999-2000, and during the period ending March 2001 when the project was wounded up due to non-extension of grant following activities were completed:

Adult susceptibility tests: Susceptibility tests using laboratory reared and sugar fed *An. stephensi* (F_1) against deltamethrin, cyfluthrin and lambdacyhalothrin showed 92.3% (n=300), 92.3% (n=180) and 89.8% (n=180) mortality, respectively, which is indicative of development of tolerance. These insecticides are being used for indoor residual spraying in the malaria control programme in the city for the last few years. Median knockdown time (in minutes) of *An. stephensi* against these insecticides was recorded as 13.9 (n=198), 12.1 (n=99) and 15.2 (n=165) respectively. Median knockdown tests will now be carried out using fully susceptible strains to compare the results. Both the adult susceptibility and median knockdown tests were also carried against *Ae. aegypti* and *Cx. quinquefasciatus*.

Additionally, median knockdown time (in minutes) was also recorded by exposing 11 specimens (glucose fed, F_1 generation) each in three replica of the three mosquito species. Median knockdown time for *An. stephensi* against deltamethrin, cyfluthrin and lambdacyhalothrin was recorded as 13.9 (12.3-17.3), 12.1 (9.0-14.7) and 15.2 (14-16.7) minutes respectively. Similarly for *Ae. aegypti* and *Cx. quinquefasciatus* these were 11.3 (9.7-11.3), 8.9 (7.7-10), 15.6 (13.7-18.3) and 49.7 (46-53.3) and 23.3 minutes respectively. *Cx. quniquefasciatus* was not tested against lambdacyhalothrin. Median knockdown times of the three mosquito species from non-synthetic pyrethroid sprayed areas will be evaluated for comparison purpose.

Mosquito breeding in domestic sources: Five different land-use areas (approx. 500x500 m) representing slum (528 houses), agricultural area (175 houses), high rise (12 buildings), society (444 houses) and typical rural (133 houses) were selected as sentinel sites for assessing breeding potential of domestic breeding sources. In addition, special surveys of ongoing major constructions are also undertaken to assess the breeding potential of water sources associated with them.

In the 13 surveys carried out 103909 domestic breeding habitats were checked in 16402 houses visited. In all 675 (0.65%) habitats were found with mosquito breeding and 505 (0.49%) containers for anophelines. Maximum (2.01%) sources were found with breeding in high rises followed by peri-urban agricultural area (1.63%). Latter also supported maximum (1.32%) breeding of anophelines followed by societies (0.67%) and typical rural type setting (0.60%). Among the domestic water storage practices checked, ground level tanks supported maximum breeding (3.26%) followed by overhead tanks (2.63%) and barrels (1.23%). Underground tanks, jerry cans, mud pots and others accounted for less than 1% breeding positivity. Average Brateau index was recorded as 0.47, which was largely contributed by high rises (1.23) followed by rural type area (0.93) and slums (0.47). During the first quarter of the year, proportion of containers with anopheles breeding ranged from 0.26-0.32% followed by 0.51-0.91% in the second quarter. Proportion of breeding positive containers for anophelines further declined during the third (0.68-0.77%) and the fourth (0.39-0.48%) quarters. *An. stephensi* was observed to breed predominantly (>97%) in containers found positive for anopheles breeding in all areas except in slums. In the construction sites (132), only 85 (0.29%) water collections were detected with anopheles breeding from the total 29467 checked.

Monitoring of mosquito densities: Mosquito densities were monitored by pyrethrum spray catches and larval surveys were carried out in the sentinel sites and ongoing building constructions in collaboration with the Surat Municipal Corporation. Average room densities were: 0.04 (*An. stephensi*), 1.43 (all anophelines), 0.16 (*Aedes* spp.) and 14.2 (*Culex* spp.). Density of *An. stephensi* was highest the west zone of the city. *An. stephensi* comprised 2.48% among all anophelines. Total anophelines comprised 9.07% among all mosquitoes. Contribution of *Aedes* and *Culex* species to the total mosquitoes was 1.02 and 89.91%, respectively. The density of *An. stephensi* remained nearly static (0.03-0.04/room) during January-April 2001. Room density of *Culex* spp. increased from 13.9 in January to 22.84 in March and again declined to 10.65/room in April. That of *Aedes* spp. ranged from 0.16-0.2 during this period. Only three anopheline species were

collected in the pyrethrum spray collections and the fauna was dominated by *An. subpictus* (93.8%).

Present status: Completed in March 2001.

2. Phase III evaluation of bifenthrin 10% WP and deltamethrin 25% WG indoor residual spraying for malaria vector control in India:

Investigators: **Dr. R. S. Yadav, Dr. T. Adak, Dr. N. Nanda, Dr. H.C. Srivastava, Dr. S. K. Subbarao (all MRC), and Dr. B. R. Thapar (NAMP)**

Funding Agency: **WHO Pesticide Evaluation Scheme (WHOPES), WHO, Geneva**

Duration of project: 2 years beginning June 2000.

Objectives of the study are:

- To compare the persistence of bifenthrin 10%WP and deltamethrin 25%WG at 25mg/m^2 dose on common local surfaces
- To compare the impact of bifenthrin and deltamethrin indoor residual spraying on the elements of vectorial potential, such as on resting and biting density, blood feeding rate, survival rate and sporozoite rate, and on vector behaviour
- To record possible side effects on spraymen and perceived side effects by sleepers of the sprayed rooms
- To measure cost-effectiveness of bifenthrin and deltamethrin indoor residual spraying compared with malathion indoor residual spraying

Progress of work done: Phase III study was initiated in June 2000 for evaluation of bifenthrin 10%WP and deltamethrin 25% WG formulations for malaria vector control. The study is being carried out in the 18 villages (pop. 53,000) of Kheda and Anand districts. During June 2000 to June 2001 base line entomological data were generated in nine sentinel villages. Mosquito collections were made by pyrethrum space spraying, exit-trap, light trap, pit shelter and human landing collection methods in nine sentinel villages. Species of the field-collected mosquitoes were identified and recorded. Ovaries of semi-gravid *Anopheles culicifacies* were extracted and preserved for identification of sibling species. Mosquito blood meal samples and heads and thoraces of *An. culicifacies* were collected for host identification and sporozoite-ELISA, respectively.
After collection of baseline entomological data for one year, the sentinel villages were randomized into three arms (each with 6 villages) for spraying of bifenthrin, deltamethrin and unsprayed control group for comparison. First round of insecticide (bifenthrin @ 25mg/m^2 and deltamethrin @ 20 mg/m^2) spraying was undertaken in the month of July 2001. 97.6% insecticide coverage was achieved in deltamethrin sprayed villages and 98.02% in bifenthrin sprayed villages. One day after the spraying, 5 samples each from

sprayed walls and wooden surfaces were scrapped (10x10 cm area) from five houses in each arm for insecticide residue analysis. Whereas the densities of *An. culicifacies* during the pre-spray baseline period were comparable, these declined in the villages after spraying with deltamethrin and bifenthrin. During post spray period, density of *An. culicifacies* ranged from 0.14 to 0.89/room, 6.56 to 8.4/room and 10.8 to 24.52/room in villages sprayed with bifenthrin, deltamethrin and unsprayed control, respectively. Bioassays on wood and mud plastered wall sprayed surfaces with deltamethrin and bifenthrin revealed 100% mortality of *An. culicifacies* up to 60 days after spray. Significant decline has also been observed in the human landing catches of *An. culicifacies* and other mosquitoes in post-spray period. Pre- and post-spray surveys of impact on non-target organisms have also been conducted to know the effect of spraying of deltamethrin and bifenthrin. A survey of any side effect perceived by householders was also carried out in each sprayed area through a semi-structured questionnaire. 60 householders have been interviewed after one month of spraying. Further study is in progress.

Present status: On going.

3. Comparative evaluation of bio-efficacy and persistence of mosquito nets treated with deltamethrin tablet formulation against malaria vectors *Anopheles culicifacies* and *An. stephensi.*

Investigators: **Dr. R.S. Yadav and Dr. R.M. Bhatt**

Funding Agency: **Aventis CropSciences (formerly AgrEvo India Limited), Mumbai**

Duration of project: One year beginning June 2001.

Progress of work done: Deltamethrin tablet formulation (K-O tab) is being evaluated for its bio-efficacy and persistence on three different types of netting materials viz., nylon, polyester and cotton against malaria vectors *An. culicifacies* species C and *An. stephensi* (Nadiad strain). Both the species were found susceptible to deltamethrin (0.05%) during baseline susceptibility tests. Three villages viz., Vaghjipura (pop. 100), Ambaipura (pop. 215) and Haripura (pop. 167) in Kheda district were selected for this trial. The villagers are habitual of using mosquito nets due to persistent mosquito nuisance owing to the proximity of these villages to a large irrigation water tank. Population census was carried out, the houses were numbered and informed consent of the head of family was obtained for participation in the trial. Nets were treated with deltamethrin K-O Tab @25 mg/m^2 and distributed in the villages, one per family during June and July 2001. In all 93 nets (both treated and untreated) were distributed in three villages (31 of each type). A set of 4 nets (2 each treated and untreated) of each fabric has been kept in the laboratory for evaluation of shelf life of treated nets. Monthly cone bioassays were carried out using laboratory reared *An. culicifacies* and *An. stephensi* (4 replicates of 15 mosquitoes each) by exposing on the treated surface for three minutes and holding for 24 hours. Mosquitoes were also exposed on the untreated nets to serve as controls (2 replicates of 15 mosquitoes). To evaluate the impact of washing on the efficacy and persistence of

insecticide on different types of fabrics, treated and untreated (8 each) nets were washed at one-month interval. A batch of nets (4 each, treated and untreated) was given a second wash at three months interval. Bioassays were carried out on the washed nets (after one as well as two washings) similar to the unwashed treated and untreated nets. Bioassays so far carried out have yielded 100% knockdown within 15 minutes of holding of both the species post-exposure and no change has been observed on the pattern of mortality due to washing of nets.

Present status: On going.

List of New Projects

1. Assessment of the impact of Sardar Sarovar Narmada water resources development project on communicable diseases with particular reference to mosquito-borne diseases.

2. Evaluation of insecticide resistance in mosquito vectors in Gujarat, Daman and Diu.

Equipment Requirement

1. Liquid nitrogen containers- 2 nos.
2. Stereoscopic microscope with built-in light source-2.

Field Station Panaji, Goa

1. Studies on *Anopheles stephensi* breeding ecology with special reference to its distribution in high risk malaria focus in Panaji, Goa.

Principal Investigator: **Dr. Ashwani Kumar**
Field Support : **Staff MRC Goa**
Duration : **Up to Jan. 2002**
Funds : **IDVC**

This study was initiated on the request of Directorate of Health services, Goa in Feb. 2001 to (1) Assess relative contribution of various habitats to *An. stephensi* breeding (2). Study seasonal spatial distribution of vector and contribution of various habitats to its dispersion (3). Recommend appropriate vector control action programme.

To meet objectives of the study a 5 sq. km area of Panaji city was selected and vector breeding surveys were conducted. Immature sampling was done in potential *An. stephensi* habitats and detailed records were prepared of both negative and positive status of each habitat in the pre-designed forms. The data was analyzed month-wise for each habitat to study vector contributions based on emergence of adults in insectary from the immature stages obtained from field.

Preliminary analysis of results showed that in all 15330 major and minor habitats falling in 37 categories were sampled for mosquito immature stages. Of these 192 (1.25%) were positive for vector. The contribution of these habitats to vector positivity ranged from 0.12% - 33.3%. On the other hand, 500 (3.26%) habitats were positive for culicines. As per prior understanding report of positive habitats was provided to the Health services within 24 hours for necessary anti-larval treatment. The study is in progress. Further analysis of data on seasonal distribution and dispersion of vector will be done on the completion of the study in Jan. 2002.

2. Isolation, Characterization, Identification and Efficacy studies on mosquito-pathogenic bacilli from soils of Goa.

Principal Investigator : **Mrs Kulvir Sra**
Co-investigators **: Dr. Ashwani Kumar and Dr. U. M. X. Sangodkar**
Status **: Completed and Ph. D. awarded**

This study was concluded in December, 2000 and the results were submitted in the form of thesis for the award of Ph.D. degree by the Goa University to Mrs Kulvir Sra. The thesis was submitted in Jan. 2001 and the viva voce examination has been successfully conducted in October, 2001. This research has provided three promising strains of Bacilli, which have been characterized, identified and bio-assayed. The primary powder formulations have been prepared and tested against *An. stephensi, Cx. quinquefasciatus* and *Ae. aegypti* larvae with promising results. The cultures have been stored in IMTECH Chandigarh which is mandatory. Further studies are being planned to ferment, pellet, field test and develop above three isolates further into bio-larvicides.

3. Field trials with Wockhardt formulation of *Bacillus thuringiensis israelensis* :

Principal Investigator: **Dr. Ashwani Kumar**
Field work support: **Staff, Field Station, Goa**
Funds: **Extramural**

Experiments were conducted to test the field efficacy of Wockhardt formulation of Bti against culicines and Anophelines in various breeding habitats. The experimental and control trials were run concurrently. The formulation was found to be highly effective against both Culicines in anophelines in a variety of conditions. Fountains, Curing waters, pits, septic tanks and drains containing mosquito breeding were treated with *Bti* and monitored on different days. The per dip densities of mosquito immature were estimated instar wise and impact was assessed following Abbot's formula. The project has been concluded and the data has been analyzed. This Centre was entrusted with the responsibility to compile detailed report on multi-centric field trials carried out with this formulation at Goa, Shahjahanpur and Haldwani field stations. The report was submitted in the month of August, 2001.

4. Quality Assurance tests on Paracheck-Pf diagnostic kits supplied to NAMP Delhi:

Principal Investigator : **Dr. Ashwani Kumar**
Co-investigators : **Mrs. Maria D'Souza and Mrs. Sushma Bhinge**
Funds : **RITES India Ltd.**
Status : **Completed**

Objective: To test the Sensitivity, Specificity and Efficacy of rapid diagnostic test kits Paracheck-*Pf* (manufactured by M/S Orchid Biomedical Systems, Verna, Goa) lot being supplied to NAMP.

Client: Rites Limited (a Govt. of India Enterprise), procurement agency for National Anti Malaria Programme for World Bank Funded Enhanced Malaria Control Project.

ICMR Approval: Ref. 75/15/2001-ECD-II dated 04-05-2001

Scope: The scope of the project was limited to one time testing of three batches 32027A, 32027B and 32027C containing 1.25 Lac Paracheck-*Pf* tests prior to their supply to various destinations as recommended by the National Anti Malaria Control Programme and reporting of quality status as outlined in the objectives to the procurement consultants, Rites Ltd. New Delhi. Samples of kits were drawn by the Drugs inspector as per laid down procedures and 100 test strips were provided to test quality in the field and lab. Detailed test report were submitted to RITES, ICMR, MRC, DHS, Goa, Directorate of Food and Drugs Administration, Govt. of Goa.

Inference:

1. Sensitivity = 100%
2. Specificity = 100%
3. Positive Predictive Value = 100%
4. Negative Predictive value = 100%
5. Efficacy = 100%
6. Parasitaemia Range (*P. falciparum*):

a). Field tests = 470 to 35535 *Pf* parasites/③*l* of blood

b). Lab. samples = 425 to 59428 *Pf* parasites /③*l* of blood.

7. Cross reactivity with *P. vivax* = Nil as in all the 29 slide positive *P. vivax* cases Paracheck-*Pf* was negative.
8. False Positive or negative= Nil as all the kit positive *Pf* cases were also slide positive for *P. falciparum*.

5. Bio-environmental control of mosquitoes in Mormugao Port Trust areas, Vasco-da-Gama, Goa.

Principal Investigator	:	Dr. Ashwani Kumar
Technical Support	:	Staff Field Station Goa
Administrative Support	:	Staff MRC Delhi Admn.
Funds	:	Mormugao Port Trust
Status	:	Till Feb. 2002

Weekly monitoring of breeding sites and progress of bio-environmental measures was done and reports were submitted to the MPT authorities. Since the inception of this project, on the advise of MRC, the Civil Engineering Department of MPT has taken following anti-mosquito action. 395 out of 837 septic tanks (47.2%), 21 sumps out of 295 (7.3%), 348 overhead tanks out of 1649 (21.1%), which were defective, have been made mosquito-proof. 72 (14.3%) out of 503 soak pits were recharged to facilitate absorption of water while 123 drains were either cleared or made cemented to ensure efficient drainage of water to prevent mosquito breeding. 1464 (37.1%) inspection chambers out of 3946 were sealed to prevent mosquito breeding. Similarly, 16 cement tanks were demolished to prevent water stagnation and breeding of mosquitoes. 45 pits or depressions were filled up with soil and leveled. 30 large PVC tanks were got disposed off to prevent breeding. 10230 *Aplocheilus blocki* larvivorous fishes were introduced in various breeding habitats viz., Wells, fountains, underground tanks, drains, rainwater collections. Disposal of scrap that could hold water was done with the help of Material and Management Department and Mechanical Engineering Departments. A large number of other small containers were regularly disposed off to prevent breeding of mosquitoes based on MRC survey reports. For the assessment of impact of various intervention measures, regular fortnightly mosquito density estimation was done. The action taken, reports submitted by various sections of Civil Engineering Department of MPT were analyzed and cross-verified by spot visits during weekly inspections. Monthly review meetings with senior officials of Engineering and Medical Department officials were held to expedite engineering interventions for mosquito control in the Port area. The impact assessment has shown that over all mosquitogenic potential of the Harbour, residential colonies of the port as well as industrial areas of the port has reduced significantly.

6. Investigations in to malaria outbreak in Sanguem, Goa :

Principal Investigator: Dr Ashwani Kumar
Co-Investigator: Mrs Nandini Korgaokar, Assistant Entomologist, NAMP, Goa.
Technical Support: Staff MRC and NAMP Goa
Status: Completed

A 13 member joint team of MRC Goa and NAMP with Officer-In-Charge, MRC Goa as team leader investigated in to the outbreak of malaria in Sanguem PHC, Goa. They carried out both entomological and parasitological investigations and provided detailed report to the Directorate of Health Services, Goa with their recommendations. The report findings were discussed and remedial measures suggested were implemented. The outbreak has now been effectively controlled.

7. Monitoring of *Aedes* populations in Mormugo Port Trust and surrounding areas, Vasco-da-Gama, Goa.

Principal Investigator : **Dr. Ashwani Kumar**
Field Support : **MRC Staff**
Status : **Ongoing up to Feb., 2002.**

The field station has initiated monitoring of *Aedes aegypti and Aedes albopictus* breeding in the Mormugao harbour, residential colonies of port employees and nearby SADA slum in Feb. 2001. Monthly surveys were conducted in the container habitats and both *Aedes aegypti* and *Aedes albopictus* were found breeding. In general maximum problem of Aedes breeding associated with domestic barrels with stored water was found in SADA slum. The problem of immature breeding was comparatively much less in Harbour area and MPT residential colony. The data has been analyzed to work out House Index (HI), Container Index (CI) and Breteau Index (BI) for Aedes immature in different months. The findings showed that maximum potential existed in the neighbouring SADA Slum area.

8. Malaria Clinic: Malaria clinic provides referral services for the diagnosis of malaria to the private practitioners, DHS and Goa Medical College. In the year 2001, 164 cases were referred and 17 were positive for malaria (SPR= 10.3%) and of these 11 were *P. vivax* and 6 had *P. falciparum* (Pf%=35.3) infection. Besides, 282 blood smears sent by the NAMP Goa were cross-examined for malaria of which 10 were positive for *P. vivax* malaria.

Other Activities:

1. **Local Research Advisory Committee:** As per the advise of SAC 2000, a Local Research Advisory Committee of Goa Filed station was constituted with Director of Health Services, Goa as its Chairman. The first meeting was held in June, 2001 and various recommendations were made by this committee. Most importantly, the NAMP programme identified research inputs that were needed by the programme. These identified research projects were listed according to priority of the NAMP, Goa. A thorough discussion on each of the short listed projects was held in September, 2001 and they are being proposed for the year 2002 under the heading of New Research Programmes of Goa Field station. The Senior officials of the NAMP will act as co-investigators in these research projects.
2. **Summer Placement of M.Sc. Microbiology students :** Two students visited MRC Field Station from Goa University for a month and attended extensive training programme designed for them both in the lab and field. They were given expert lectures on different aspects of malaria and strategies for malaria control. Upon successful completion of their Summer Training they submitted a detailed training report and delivered seminars on malaria in the Goa University.
3. **Film on Mosquito control measures in Konkan Railways project:** A film has been shot by the Audio-Visual Cell of MRC headed by Dr. M. S. Malhotra. The film shooting has been completed highlighting various remedial mosquito control measures adopted by Konkan Railways Corporation on the recommendations of Goa Field Station. The final editing of the film is in progress and a rough cut has been circulated for suggestions from ICMR and all other concerned.
4. **RBM Evidence Based Situational Analysis:** Since Goa state has been selected for launching RBM initiative in the first phase of piloting strategic action programme, a detailed evidence based investigation was carried out in September, 2001. All the staff members of Goa Field Station provided necessary logisitcal and technical support to the team of MRC and NMAP Delhi led by Dr. M. A. Ansari.

New Project Proposals: Recommended by Local Research Committee

1. Malaria Among labour Population in Goa.

Principal Investigator : **Dr. Ashwani Kumar, OIC, MRC Goa**
Co- Investigators : **Mr. M. B. Kaliwal, State Entomologist, NAMP, Goa.**

Technical Support : **Staff MRC and NAMP Goa.**
Duration : **Two years (2002-2003)**

Project Summary: Malaria in Goa is construction work related to a very large extent and labour is migratory. The broad objectives of this project are to study State and District wise composition of migrant labour, their age and sex wise composition, their

inhabitation, movement, sleeping behaviour, incidence of malaria and biting rhythm. This project will help in taking appropriate intervention measures for malaria transmission control.

2. Studies on Chloroquine sensitivity in *P. falciparum and* Characterization of *P. falciparum* strains being transmitted Goa.

Investigators :
Dr. Ashwani Kumar, Dr. Elmira Pereira Braganza, HO, NAMP Goa, Dr. Sarla K. Subbarao, Dr. Y. D. Sharma, Dr. M. A. Ansari, Dr. Hema Joshi and Dr. Neena Valecha.

Technical Support : **Staff MRC Goa and Delhi and NAMP Goa.**
Duration : **One year (2002)**
Funds : **IDVC, MRC, AIIMS.**

Objectives: To study the in vivo chloroquine sensitivity in *P. falciparum* amongst local and labour populations following 28 days standard WHO protocol. To determine the quantum of recrudescence and re-infection based on genetic molecular markers and to characterize *P. falciparum* strains in Goa.

3. Field Efficacy study of bio-larvicide *B. thuringiensis israelensis* Vectobac WDG in selected breeding habitats as a part of Multicentric trial.

Investigators: Dr. Ashwani Kumar, Dr. T. Adak, M. B. Kaliwal, Mrs Nandini Korgaonkar Assit. Entomologist, NAMP Goa.

Technical Support : **MRC Staff Goa.**
Duration : **One Year**
Funds : **Sponsored by Agro Evo in Contract research mode.**

The Objective of the project is to assess the field efficacy of *Bti* Vectobac WDG formulation in some selected *An. stephensi*, *Cx. quinquefasciatus* and *Aedes aegypti* breeding habitats. The sites of field trials will be Panaji, Porvorim and Vasco da Gama towns of Goa. The spraying and impact will be monitored as per the common protocol for the multi-Centric trial prepared in MRC Delhi.

4. Sustainability of biological control with larviviorus fishes in wells: re-introduction frequency and conditions suitable for their survival and efficacy.

Investigators: Dr. Ashwani Kumar, Mr. M. B. Kaliwal, Mrs Nandini Korgaonkar Assit. Entomologist, NAMP Goa.

Field Support : **MRC Goa and NAMP Goa staff.**
Duration : **Two years 2002-2003**

Objective: This study is aimed at assessing the sustainability of bio-control with larvivorous fishes in some selected habitiats of urban malaria vector *An. stephensi* such as wells, fountains, Tanks and temporarily disused swimming pools. At the end of this

study, the re-introduction frequency in each vector habitat and the physical and biological characteristics of the breeding habitats that favour fish survival and sustainability will be known. This project is of practical value for the NAMP in Goa and the results will be implemented for vector control in Goa.

5. Feasibility study on ITMN based malaria transmission control in construction sites.

Investigators: Dr. Ashwani Kumar, Dr. T Adak, Mr. M. B. Kaliwal State Entomologist, Goa, Mrs Nandini Korgaonkar Assit. Entomologist, NAMP Goa.
Field Support: MRC and NAMP Staff.
Funds and Material : Extramural/Sponsored
Objective: The boad objective of the project is to ascertain whether ITMN is useful in malaria transmission control amongst labour population. The project will be launched after careful assessment of baseline information generated in the project No.1 and results of entomological and parasitological findings will be compared between net area and no net area. Base line KABP study will be done to ascertain choice of nets, usage, re-treatment and its sustainability for durable vector control.

Focus: Hotel Workers

Field Station Rourkela

1. Development of a Field Trial Site For Malaria Vaccines:

A DBT funded extramural collaborative project of MRC and ICGEB is in progress in Sundargarh district to prepare field trial site for efficacy trials of malaria vaccines. On the basis of preliminary parasitological and entomological surveys, the following two sets of villages under Gurundia and Birkera PHC's of Sundargarh district were selected :

High incidence villages: These constitute a set of 8 villages with a total population of 2058 and located deep in forests close to the streams, under the influence of *An. fluviatilis* and having persistent transmission. These villages are: Tamara, Jagada, Pandripathar, Chirobeda, Baghiakacha and Benuam all under Gurundia PHC; Rangamati and San Dolakudar under Birkera PHC. The villages are approachable round the year.

Low incidence villages: A set of five villages viz., Sarala, Mahaliapally, Mallickpally, Chikatmati and Bhalupatra with a total population of 2163 under Birkera PHC have been selected. These villages are situated in the plain area close to a perennial river and are under the influence of *An. culicifacies*. Malaria transmission is seasonal and at low level.

Tribals predominantly inhabit the study villages. There are eleven recognized tribal communities out of which Oram, Munda and Khadia are predominant. Male & female population in the study villages is 51 and 49 % respectively and literacy rate is 47.6 %. The villages represent low socio-economic status of the people and majority of the villagers are subsistence farmers. The geographical reconnaissance and mapping of villages has been completed and creation of GIS database is in progress.

The longitudinal & cross-sectional surveys were initiated from the month of August'2000. Active case detection at weekly intervals in all the villages has been conducted through village volunteers. The monthly parasite index (MPI) and Pf % in forest area was ranging between 25-50 and 80-95 % respectively whereas in plain area villages these were in thee range of 5-25 and 55-75 % respectively. Malaria incidence was more in younger age groups of 0-5 years. Mass blood surveys were conducted in all the study villages at quarterly intervals beginning September'2000. The SPR and SFR in forest area were ranging between 20-25 and 15-22.0 respectively whereas in plain area villages these were 2-5 and 1-4 respectively. The spleen rate in children living in forest area villages was above 75 % throughout the year and also in adults it was above 40 % thereby showing hyperendemicity of the area whereas in plain area the spleen rate in children & adult was 60 and 12 respectively.

The entomological surveys revealed the prevalence of two-vector species viz., *An. culicifacies* and *An. fluviatilis* in forest area villages and the density was ranging between 6.0-32.0 and 0.2-26.0 respectively. In plain area villages, the *An. fluviatilis* was totally absent and density of *An. culicifacies* was in the range of 6.5 to 25.5. The mosquito landing rate of *An. fluviatilis* & *An. culicifacies* in forest area was found to be 16.3 and 0.4 bites/person/night whereas, in plain area it was nil and 0.2 bites/person/night

respectively. The sporozoite rate in *An. fluviatilis* and *An. culicifacies* were found to be 2.82 and 0.70 respectively and entomological inoculation rate (EIR) for these species was calculated as 0.46 and 0.005 infective bites per person per night in the forest area villages. Programme for computer based data entry system has been developed.

2. Malaria Transmission Dynamics And Field Studies On *P. Falciparum* Malaria In Tribal Area :

The study was continued as a part of collaborative project of MRC, Ispat General Hospital, Rourkela and International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi. The study village is a small remote tribal village with a population of 264 under Birkera PHC of Sundargarh district. The study area is characterized by high falciparum malaria and asymptomatic carriers. Longitudinal surveys involving weekly active surveillance and entomological surveys and cross-sectional mass blood surveys are being carried out. The parasite index during the year ranged between 38.0 to 133.0 with a total of 628.8 for 9 months ending September. Infant parasite rate (IPR) was 60.0. The slide positivity rate (SPR) during three mass blood surveys in March, June and September were 6.1, 12.1, and 11.7 respectively. During mass surveys more than 50 % cases were asymptomatic.

The density of *An. culicifacies* and *An. fluviatilis* ranged between 9.5-41.5 and 0-6.5 respectively. The sporozoite rate and average mosquito-landing rate on human for *An. culicifacies* were 0.94 and 2.4 whereas for *An. fluviatilis* these were 2.93 and 8.0 respectively. The entomological inoculation rate (EIR) during low, moderate and high transmission seasons were nil, 0.022 and 0.23 infective bites per person per night respectively.

3. Susceptibility Status Of Malaria Vector Species:

Insecticide susceptibility tests on wild caught fully fed mosquitoes of *An. culicifacies, An. fluviatilis* and *An. annularis* from Birkera & Gurundia PHC's of Sundargarh district were performed against 4 % DDT, 5 % Malathion and 0.05% Deltamethrin impregnated papers as per WHO procedure. The tests showed that *An. culicifacies* and *An. annularis* are resistant to DDT with only 16.4 & 5.8 % mortality respectively whereas both the species are susceptible to Malathion and Deltamethrin. *An. fluviatilis* is susceptible to all the three insecticides.

4. Host Feeding Behaviour Of Malaria Vector Species:

In order to know the host feeding behaviour of vector species in Sundargarh district, the mosquitoes blood meal analysis were carried out by gel diffusion method. 2131 blood meal samples of *An. culicifacies,* 411 samples of *An. fluviatilis* and 469 samples of *An. annularis* were assayed and human blood index (HBI) was found to be 0.03, 0.63 and 0.04 respectively. The study showed that *An.fluviatilis* is highly anthropophagic in this area.

5. Prevalence Of G-6PD Deficiency And Estimation Of Haemoglobin In The Tribal Population:

310 blood samples collected from eight villages in the forest area of Birkera & gurundia PHC and 263 samples from five plain area villages were assayed by fluorescent spot test for G-6 PD deficient individuals among ethnic tribes of Sundargarh district. The results showed that 18.7 and 16.0 % individuals in forest & plain area respectively were G-6 PD deficient. Similarly, 1001 and 798 persons from forest & plain area respectively were screened for haemoglobin levels and it was found that only 38.5 and 54.2 % of the population from forest & plain area respectively were having Hb above 11g/dl. About 20 % of the tribal population in both the area was having Hb less than 7g/dl.

6. Malaria Clinic:

During the year, 4745 patients reported at the malaria clinic were screened for malaria parasite and out of which 482 were found positive for malaria (Pv: 230, Pf: 243, Pm: 5, Mix: 4). The slide positivity rate (SPR) and slide falciparum rate (SFR) were 10.2 and 5.2 respectively with Pf % of 51.2 . All the cases were given radical treatment as per NAMP drug policy.

Field Station Shahjahanpur

Studies Conducted:

1. Geographical reconnaissance (GR) for mapping of mosquito breeding sites was carried out in urban areas of Shahjahanpur District. Potential breeding sites found during the surveys were pond, pools, pits, ditches, drains hand pumps, wells, ground tanks, over head tanks, rivers, coolers, pitchers, stagnant water bodies on streets, flower pots, nallahas, tyre collections. The study revealed high mosquitogenic potential in these areas.

2. Adult mosquito collections were carried out from villages of Dadroul PHC of the district Shahjahanpur. High mosquito densities of malaria vector species *An. culicifacies* were found in riverine areas, Whereas high densities of culicine mosquitoes were recorded in urban areas, Man hour density of total mosquitoes, culicines, anophelines and malaria vector species varied throughout the study period. Thus GR imparts a great role in the Bioenvironmental control strategy as it helps in finding out the actual breeding spectrum of mosquitoes and accordingly proper control strategies may be taken. This can be further better utilized if geographical information system based on remote sensing by stellities are put together.

None of the blood smear was found positive for malaria parasite during the blood smear examination of the fever cases attended at malaria research centre. Similarly none of the blood smear of patients with suspected filariasis was found positive for microfilaria.

3. Evaluation of biocide (B.t., Wockhardt Company, Mumbai) on larval breeding of culicines and anophelines was carried out under field condition in different habitats. The product was highly effective in killing the mosquito larvae. The effect lasted for different periods depending upon the nature of breeding habitates. The product was more effective on culicine larvae and lasted for 10 days approximately.

Other Activites:

1. To make community aware of our programme and mosquito borne diseases, health camps and group meetings were organised in the district. Posters regarding prevention of malaria received from audio visual section of the MRC, Delhi were distributed in various schools of the district.

2. A large no.of fever cases were reported from some villages of Banda and Khutar PHC's of District Shahjahanpur . To see the prevalance of malaria, surveys were carried out in 6 villages of Banda PHC and 3 villages of Khutar PHC. A total of 224 blood smears of the patients with fever and those who had fever one or two days back were prepared from 6 villages of the Banda PHC. All were found negative for malaria parasite. Similarly a total of 145 blood smears were prepared from 3 villages of Khutar

PHC. Out of above, 28 smears were found positive for malaria parasite. Out of total 28 positive cases, 11 were positive for Plasmodium vivax and 17 for Plasmodium falciparum. Over all SPR and SFR recorded was 19.3 and 11.7 respectively.

3. A team comprising of 12 staff members (Dr. G.D.P. Dutta, RO, as team leader) of the field station conducted malaria investigations in the earthquake affected areas of Bhuj (Gujarat) w.e.f. 17.2.2001 to 18.3.2001.

4. Dr. Hemanth Kumar, SRS/OIC attended CVC training programme at MRC, Delhi W.e.f. 13.2.2001 to 27.3.2001.

Field Station Shankargarh

Shankargarh block is a malaria endemic area mainly due to presence of numerous breeding sites including abandoned and active silica/stone quarries. The development of insecticides and drugs resistance has resulted in increase in the number of malaria cases, especially of *Plasmodium falciparum.* The problem is aggrivated by the seasonal migration of labourers from neighbouring district.

During the year 2000-2001 the following activities were carried out at the Field Station.

Passive surveillance : The malaria clinic which is present within the PHC Campus covers the local population as well as the neighbouring villages. Patients having fever come to the malaria clinic for rapid diagnosis and get prompt treatment if found positive for malaria infection. The monthwise epidemiological data of malaria clinic for the period from Oct., 2000 to Sept., 2001 has been presented in Table-1. The data shows a distinct cycle of Pv and Pf cases. The maximum number of Pv cases were recorded in the months of July-Sept., while the maximum number of Pf cases were detected in the months of Oct.-Dec. Out of a total of 2914 blood slides examined 248 were declared positive for malaria infection, the SPR being 08.5% and SfR 02.7%.

Infant and Child Parasite Rates : The annual data of Infants (0-1 yrs.) and Children (1-10 yrs.) has been presented in Table-2. Out of 42 blood slides made of Infants only 2 were found positive, the IPR being 04.8%. Out of 699 blood slides prepared of Children, 55 were found positive for malaria infection, the CPR being 07.9%.